Carrot or Stick?

Tradability of Mobile Source Emissions in California

ARB Workshop

November 9, 2004

Thomas E. Gieskes

California Refining - Mobile vs. Stationary Emissions

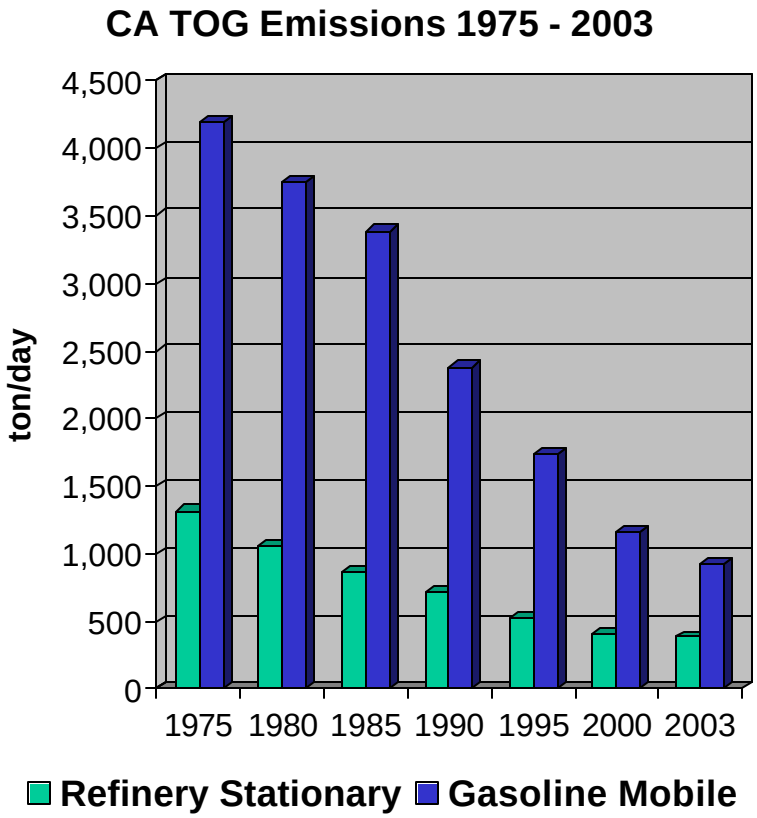
Stillwater Associates LLC

2003 Estimates ton/year*	TOG	ROG	CO	NOX	SOX	PM	PM_{10}	$PM_{2.5}$
Refining & Marketing Stationary Emissions	384.39	106.93	8.42	7.99	61.76	3.83	2.38	1.87
Gasoline based On-Road Mobile Source Emissions	914.20	843.15	8549.24	900.41	4.16	32.71	32.05	19.35

- With the exception of SOX, mobile source emissions from on-road gasoline use are far greater than the emissions from the facilities where the gasoline is produced, blended and stored
- In California, the majority of gasoline is consumed within relatively short distances from the producing centers (Bay Area, Los Angeles Basin)
- Historically, emission reductions from stationary sources have primarily been achieved through incentives: tradable emission reduction credits
- Emission reductions from mobile sources have primarily been achieved through mandated restrictions of fuel specifications and automotive technology improvements

* Source: California Air Resources Board, 2003 Emissions Inventory Almanac

Stationary Emission Reductions: Diminishing Returns



Source: California Air Resources Board, Emissions Inventory Almanac

- Further reductions in stationary emissions from refineries seem difficult
- Example: SCAQMD Rule 1178
  - Requires LA Basin refiners and large petroleum terminal operators to reduce VOC emissions from storage tanks
  - Reductions achieved by doming of open roof floating storage tanks and engineering improvements of vents
  - Total expected reductions in the order of 1 to 1.5 ton/day
  - Five year implementation schedule in order to maintain operability of critical infrastructure
  - Total estimated cost after offsetting credits in the order of $100 to $150 million, or $100 million per ton/day

Possibilities for Voluntary Mobile Source Reductions

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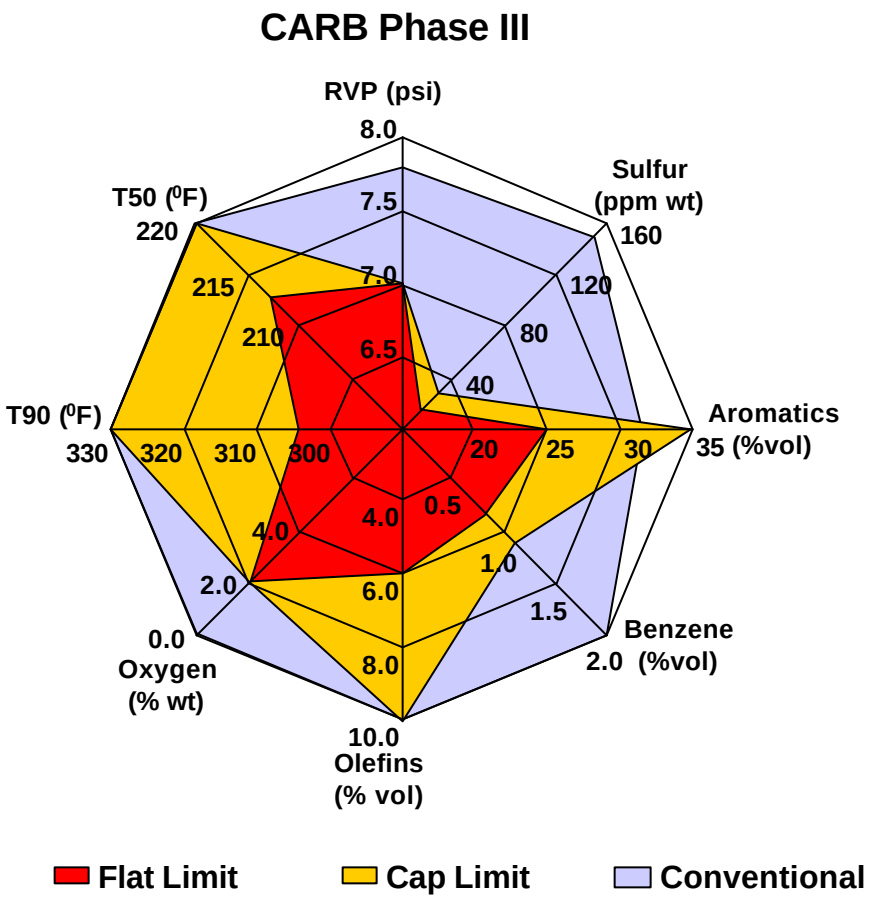

- Refiners will currently blend at the very limit of Predictable Model
- Most refiners can frequently achieve better specifications but
  - Only at higher cost, for which there is no compensation
  - At odds with Unocal patent
- With financial incentives
  - Refiners would optimize emission credits versus operating cost
  - Alternative technologies such as clean fuel additives would have a market

Potential for Mobile Source Reductions

- The Predictive Model provides the tool to calculate the effect of voluntary improvements over Reference, for instance for TOG
  - 2 ^{0}F lower T50 % lower TOG ton/year
  - 3 ^{0}F lower T90 % lower TOG ton/year
  - 1% less olefins % lower TOG ton/year
  - 0.1% lower benzene % lower TOG ton/year
  - 2% less aromatics % lower TOG ton/year

  ton/year
- Value of these emission credits is in the order of $ MM/year
- Cost to the refiners is likely to be in the order of $ MM/year
- Cost to the refiner can be substantially reduced with emerging combustion enhancing additives under alternative formulations